

SCIENTIFIC RESOURCES OF THE USSR

1. SOVIET SCIENTIFIC AIMS.

KAGANOVICH, MEMBER OF PRESIDUM OF THE PARTY AND ONE OF FIVE FIRST DEPUTY CHAIRMEN OF THE COUNCIL OF MINISTERS, IN 1955 STATED THAT, ONLY THROUGH THE WIDE AND RAPID INTRODUCTION OF THE NEWEST ACHIEVEMENTS OF OUR OWN AND WORLD WIDE SCIENCE AND TECHNOLOGY CAN WE REACH A LEVEL OF PRODUCTIVITY HIGHER THAN THAT OF CAPITALISM, WHICH IS NECESSARY FOR THE VICTORY OF COMMUNISM. WHAT DO THE SOVIETS HAVE WITH WHICH TO MEET THIS AMBITIOUS OBJECTIVE?

2. MANPOWER RESOURCES.

THE FIGURES USED HEREIN MUST BE TAKEN AS INDICATIONS OF MAGNITUDE ONLY. THEIR ACCURACY CAN NOT BE GUARANTEED.

A. HOW SOVIET SCIENTISTS ARE TRAINED.

ELEMENTARY SCHOOLS STRESS SCIENCE TRAINING AND THERE ARE NO ELECTIVES. SOVIET HIGH SCHOOL GRADUATES HAVE FIVE YEARS OF PHYSICS, FIVE YEARS OF BIOLOGY, FOUR YEARS CHEMISTRY, TEN YEARS MATHEMATICS AND A YEAR OF ASTRONOMY. RECENTLY, MORE PRACTICAL TECHNICAL SUBJECTS SUCH AS MACHINE OPERATION WERE INTRODUCED AT EXPENSE OF HUMANITIES.

**FACTORY AND TRADE SCHOOLS CONDUCT
SPECIALIZED EDUCATION TO SUPPLY SKILLED LABOR.
AT THE NEXT LEVEL ARE TECHNICUMS, ROUGHLY
COMPARABLE TO OUR TECHNICAL HIGH SCHOOLS,
WHICH CONDUCT THREE TO FOUR YEARS OF SPECIALIZED
TRAINING. MORE TECHNICUMS ARE BEING ESTABLISHED
TO ACCOMMODATE THE INCREASING DEMAND FOR
SKILLED TECHNICIANS WHO CAN NOT BE ADMITTED TO
UNIVERSITIES OR COLLEGES.**

**AT THE HIGHEST LEVEL ARE THREE TYPES OF
INSTITUTIONS:**

**(1) SPECIALIZED ENGINEERING AND TECHNICAL
COLLEGES (ABOUT 180 IN THE PHYSICAL SCIENCES)
WHICH OFFER FOUR-FIVE YEAR COURSES IN SUCH
SPECIALIZED FIELDS AS MACHINE BUILDING AND
CONSTRUCTION TO SUPPLY ENGINEERS AND
SPECIALISTS TO PARTICULAR INDUSTRIES.**

**(2) POLYTECHNICAL INSTITUTES (ABOUT 24)
OFFERING FOUR-SIX YEAR COURSES IN BROAD
FIELDS, AND**

**(3) UNIVERSITIES (33) EMPHASIZING
FUNDAMENTAL SCIENCE AND OFFERING COURSES**

5-5 1/2 YEARS IN LENGTH, GRADUATES OF WHICH
ENTER TEACHING OR RESEARCH. THE BETTER
STUDENTS ARE FUNNELED INTO RESEARCH.

THE THREE HIGHEST TYPES OF INSTITUTIONS AWARD THE
CANDIDATE DEGREE, COMPARABLE TO OUR PHD. IN
ADDITION, 4-500 DOCTOR'S DEGREES, AN ADVANCED ACADEMIC
DEGREE, ARE GRANTED EACH YEAR. ABOUT 75% OF ALL
ADVANCED DEGREES ARE AWARDED IN THE NATURAL AND
PHYSICAL SCIENCES.

B. NUMBERS OF TECHNICALLY TRAINED INDIVIDUALS.

THE USSR HAS NOW ABOUT 2/3 RDS THE NUMBER
OF SCIENTISTS THAT THE UNITED STATES HAS IN THE RESEARCH
AND TEACHING ASPECTS OF PHYSICAL AND BIOLOGICAL
SCIENCES (175,000 VERSUS 265,000).

THE USSR HAS ABOUT HALF THE NUMBER THAT U.S.
HAS IN RESEARCH ALONE (120,000 VERSUS PERHAPS 210,000).

SOVIET COLLEGES RECEIVE ABOUT 500,000 STUDENTS
AND GRADUATE ABOUT 250,000 EACH YEAR. US ENTRANTS
AND GRADUATES ARE ABOUT 10% HIGHER, BUT SOVIETS
EDUCATE MORE IN THE SCIENCES THAN WE DO.

THIS IS KEY TO OUTLOOK FOR THE FUTURE. IN 1955
MORE THAN HALF (ABOUT 60%) OF SOVIET GRADUATIONS WERE
IN SCIENTIFIC AND TECHNICAL FIELDS VERSUS ABOUT 25%

IN THE US. THE SOVIETS GRADUATED NEARLY TWICE AS MANY ENGINEERS AS DID THE US IN 1955. AT AN INCREASING RATE OF GRADUATION IN THE USSR (ABOUT 80,000 IN PHYSICAL SCIENCES AND ENGINEERING AND ABOUT 50,000 IN THE LIFE SCIENCES), THE SOVIETS WILL ATTAIN AN IMPOSING ADVANTAGE IN NUMBER OF SCIENTISTS AND ENGINEERS IN A FEW YEARS' TIME IF THEY AND WE CONTINUE AT OUR PRESENT RATES.

C. HOW CANDIDATES FOR SCIENTIFIC TRAINING ARE SELECTED.

THE DOMINANT FEATURE IN THE SOVIET SELECTION PROCESS IS THE USEFULNESS TO THE STATE OF THE POTENTIAL SCIENTIST. THE STATE THUS CONTROLS BY ADMISSIONS TO ADVANCED TRAINING THE NUMBERS OF PHYSICISTS, CHEMISTS, AND SO ON. SIMILARLY, UPON COMPLETION OF HIS EDUCATION, THE FLEDGLING SOVIET SCIENTIST IS OFFERED POSITIONS ACCORDING TO STATE NEEDS. ALL ATTEMPTS TO FAVOR SELECTION OF "PROLETARIANS" WERE ABANDONED AT THE END OF 1935.

D. WOMEN SCIENTISTS.

THE USSR EDUCATES A MUCH HIGHER PROPORTION OF WOMEN IN SCIENTIFIC FIELDS. OVER-ALL FIGURE IN USSR WAS ABOUT 50% IN 1954 WITH GREATER NUMBERS OF WOMEN IN ENGINEERING AND MEDICINE, AGRICULTURAL AND

OTHER SPECIALIZED PROFESSIONAL FIELDS THAN IN THE US. WOMEN ARE EMPLOYED LARGELY IN INDUSTRY AND TEACHING (ABOUT 35% OF ALL TEACHERS IN HIGHER EDUCATIONAL ESTABLISHMENTS ARE WOMEN).

E. INCENTIVES

FOR PROMISING STUDENTS, A STATE-FINANCED EDUCATION IN SCIENCE IS A LIKELY PROSPECT. AS ULTIMATE GOALS, THE ASPIRING SCIENTIST CAN LOOK FORWARD TO HIGH RANK EXPRESSED IN TERMS OF PREFERENTIAL TREATMENT IN SALARY, HOUSING AND PERQUISITES. STATE PRIZES WORTH SEVERAL THOUSANDS OF DOLLARS AWAIT MANY KINDS OF OUTSTANDING SCIENTIFIC ACCOMPLISHMENTS.

F. SUPPORTING TECHNICIANS.

SHORT TERM FACTORY AND TRADE SCHOOLS, AS WELL AS TECHNICUMS, PROVIDE AN ACADEMIC OUTLET FOR THE INCREASING NUMBERS OF STUDENTS NOT ADMITTED TO COLLEGES AND UNIVERSITIES. SOVIETS ARE MORE APT TO OBTAIN THEIR SKILLED FOREMEN FROM THEIR EDUCATIONAL SYSTEM THAN FROM PRACTICAL EXPERIENCE IN INDUSTRY. BETWEEN 1914 AND 1954 ABOUT 1.2 MILLION SKILLED LABORERS OF THIS CLASS HAD BEEN TRAINED IN SPECIALIZED SEMI-PROFESSIONAL SCHOOLS AND AN ADDITIONAL 600,000 SINCE

1949 HAVE BEEN TRAINED IN EXTENSION COURSES. THIS REPRESENTS A DRAMATIC EFFORT ON THE PART OF THE USSR TO OVERCOME A DEFICIENCY IN SKILLED SUPPORTING MANPOWER.

3. UTILIZATION OF TECHNOLOGICAL RESOURCES.

A. ORGANIZATION OF THE SCIENTIFIC EFFORT.

ROUGHLY COMPARABLE TO THAT OF THE US FOLLOWING THREE GENERAL LINES:

(1) BOTH FUNDAMENTAL AND APPLIED RESEARCH ARE PLANNED AND SUPERVISED BY A SYSTEM OF ACADEMIES OF SCIENCES WHICH ACCOUNT FOR ABOUT 1/10TH OF THE TOTAL SCIENTIFIC MANPOWER.

(2) INSTITUTES OF INDUSTRIAL AND OTHER ECONOMIC MINISTRIES EMPLOY ABOUT 2/5THS OF ALL SCIENTISTS. A NOTABLE EXAMPLE IS THE CENTRAL AEROHYDRODYNAMICS INSTITUTE (TSAGI) WHICH DOES WORK COMPARABLE TO THAT OF OUR NATIONAL ADVISORY COMMITTEE FOR AERONAUTICAL LABORATORIES.

(3) HIGHER EDUCATIONAL INSTITUTIONS EMPLOY THE REMAINING HALF OF THE SOVIET SCIENTISTS AS TEACHERS. THIS SEGMENT HAS

BEEN CRITICIZED FOR FAILING TO PROVIDE ITS SHARE OF RESEARCH IN THE WAY THAT AMERICAN UNIVERSITY SCIENTISTS DO.

B. RESEARCH IS NOT AS CAREFULLY PLANNED AND COORDINATED AS MIGHT BE EXPECTED IN A TOTALITARIAN ECONOMY.

THERE IS MUCH PARALLELISM SINCE EACH MINISTRY PLANS ITS OWN RESEARCH PROGRAM. THERE IS THE HEAVY HAND OF BUREAUCRACY AS SHOWN BY THE COMMENT OF THE VICE PRESIDENT OF THE SOVIET ACADEMY OF MEDICAL SCIENCES, "WE NOT ONLY ORGANIZE BADLY, BUT WE CONSTANTLY REORGANIZE." THE ACADEMY OF SCIENCES IS ATTEMPTING BY A COMMUNITY STRUCTURE TO COORDINATE ACTIVITIES ON A PROJECT BASIS.

C. ROLE OF THE COMMUNIST PARTY.

THE PARTY HAS, OF COURSE, GREAT POWER AND IS AN EFFECTIVE MEANS OF INSURING COORDINATION IN AREAS OF HIGH PRIORITY. WE CAN SEE THE EFFECT OF PARTY DISCIPLINE IN PROGRAMS, SUCH AS ATOMIC ENERGY, GUIDED MISSILES, AIRCRAFT AND ELECTRONICS. FOR EXAMPLE, THE SOVIET FIVE YEAR PLAN RECENTLY ANNOUNCED PLANS FOR CONSTRUCTION IN THE PERIOD 1956-1960 OF 2,000 TO 2,500 MEGAWATTS OF ELECTRICAL POWER GENERATING CAPACITY USING NUCLEAR ENERGY. (AS COMPARED WITH

PRESENT U.S. PLANS FOR APPROXIMATELY 800 MEGAWATTS IN THE SAME PERIOD). EVEN GRANTING AN ECONOMIC BASIS FOR THIS FORMIDABLE SOVIET GOAL, WE CAN ALSO SEE THE POLITICAL EXPEDIENCY AND THE DRAMATIC SUPPORT TO SOVIET PROPAGANDA LINES.

ON THE OTHER SIDE OF THE LEGER, PARTY INTERFERENCE IN GENETICS DURING THE LYSENKO CONTROVERSY CERTAINLY CONTRIBUTED TO THE SOVIETS' SIZEABLE AGRICULTURAL PROBLEMS. GENERALLY SPEAKING, HOWEVER, PARTY INTERFERENCE HAS NOT PRESENTED A MAJOR OBSTACLE TO PROGRESSIVE RESEARCH.

D. FUNDS.

ANNOUNCED EXPENDITURES FOR RESEARCH ARE COMPARABLE TO (PERHAPS GREATER THAN) THOSE OF THE U.S. IN TERMS OF PER CENT OF GNP (ABOUT 1%). HOWEVER, THE SOVIET GNP IS ONLY ABOUT 1/3 THAT OF THE U.S.

E. DISSEMINATION OF SCIENTIFIC KNOWLEDGE.

THE SOVIETS HAVE A COMPREHENSIVE SYSTEM OF ABSTRACTING OF THE WORLD'S SCIENTIFIC LITERATURE WHICH PUTS THEM IN AN ENVIABLE POSITION TO EXPLOIT FOREIGN DEVELOPMENTS. WE HAVE EXAMPLES OF AMERICAN CHEMICAL JOURNALS BEING ABSTRACTED AND TRANSLATED IN PART OR

IN TOTO SO AS TO BE IN THE HANDS OF SOVIET RECIPIENTS
WITHIN TWO MONTHS OF THE AMERICAN PUBLICATION DATE.
OUR CHEMICAL ABSTRACTS ON THE AVERAGE RUNS ABOUT
EIGHT MONTHS BEHIND ORIGINAL PUBLICATION DATE.

4. ACHIEVEMENTS.

THE ACHIEVEMENTS OF SOVIET RESEARCH VARY ACCORDING
TO THE NATURE OF THE RESEARCH ITSELF AND THE FIELD OF PROBABLE
APPLICATION. GENERALLY, SOVIET SCIENTISTS ARE QUITE GOOD IN
THEORY; IN THE THEORETICAL ASPECTS OF PHYSICS, FOR EXAMPLE,
THE SOVIETS ARE PERHAPS ON A PAR WITH ANY COUNTRY IN THE
WORLD, THEIR THEORETICAL METALLURGY IS OUTSTANDING, AND SOME
OF THEIR RESEARCH INTO THE HUMAN NERVOUS SYSTEM, FOLLOWING
THE PAVLOVIAN SCHOOL, IS QUALITATIVELY UNIQUE. THEY MAY TEND
TO LAG A BIT IN EXPERIMENTAL WORK, BUT THERE ARE ENOUGH
EXCEPTIONS HERE TO MAKE ^{SUCH} ~~SURE~~ A GENERALIZATION PRECARIOUS.
CERTAINLY WE HAVE TO GIVE FULL CREDIT TO THEIR DEVELOPMENT OF
THEIR TEN BILLION ELECTRON VOLTED PROTON SYNCHROTRON, THE
LARGEST PARTICLE ACCELERATOR IN THE WORLD.

5. SCIENTIFIC RESEARCH AND TECHNOLOGICAL DEVELOPMENT.

SOVIET RESEARCH ACHIEVEMENTS AFFECT SOVIET TECHNOLOGY
BY A SYSTEM OF PRIORITIES. THE SOVIET ECONOMY DOES NOT HAVE
THE CAPACITY TO ABSORB RESEARCH RESULTS IN ALL FIELDS AS DOES

OURS. GREATEST USE OF RESEARCH RESULTS THEREFORE IS MADE IN AREAS ESSENTIAL TO NATIONAL POWER AND MILITARY STRENGTH AS OPPOSED TO THE CONSUMPTION SECTOR OF THE CIVIL ECONOMY. THE LATTER HAS BEEN LITTLE AFFECTED BY SCIENTIFIC RESEARCH AND DEVELOPMENT.

SUMMARY

THESE ARE HIGHPOINTS OF THIS REVIEW OF SOVIET SCIENTIFIC RESOURCES:

A. THEIR POOL OF HIGHLY TRAINED SCIENTISTS AND ENGINEERS, NOW APPROXIMATELY EQUAL TO THAT OF US, IS BEING INCREASED AT A PROPORTIONATELY GREATER RATE THAN OURS -- IN A FEW YEARS WE MAY SEE THEM ATTAIN A DECISIVE ADVANTAGE IN TOTAL NUMBERS.

B. A VIGOROUS PROGRAM OF TRAINING OF SPECIALIZED TECHNICIANS WILL IMPROVE THEIR RELATIVE STANDING IN THIS IMPORTANT CATEGORY.

C. BY THE FUNCTIONING OF STATE CONTROL THE SOVIETS ARE ABLE TO DIRECT THE STREAM OF TRAINED SCIENTISTS IN PROPER CHANNELS ACCORDING TO NEED.

D. THERE IS NO SPARING OF FUNDS FOR SCIENTIFIC RESEARCH .

E. IT IS THE ANNOUNCED SOVIET INTENTION TO UTILIZE THE BEST OF AVAILABLE FOREIGN SCIENTIFIC

SYSTEM FOR SUCH EXPLOITATION.

**F. SCIENTIFIC ACHIEVEMENT IS ENCOURAGED BY
A SYSTEM OF AWARDS AND SPECIAL PRIVILEGES WHICH
ELEVATES SCIENTISTS TO THE TOP RUNG IN THE COMMUNIST
VERSION OF THE SOCIO-ECONOMIC LADDER.**

**G. THE USSR MAKES FULL USE OF THE CONTRIBUTION
WHICH WOMEN CAN MAKE TO ITS SCIENTIFIC EFFORT.
THESE ARE STATEMENTS WORTH PONDERING.**

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